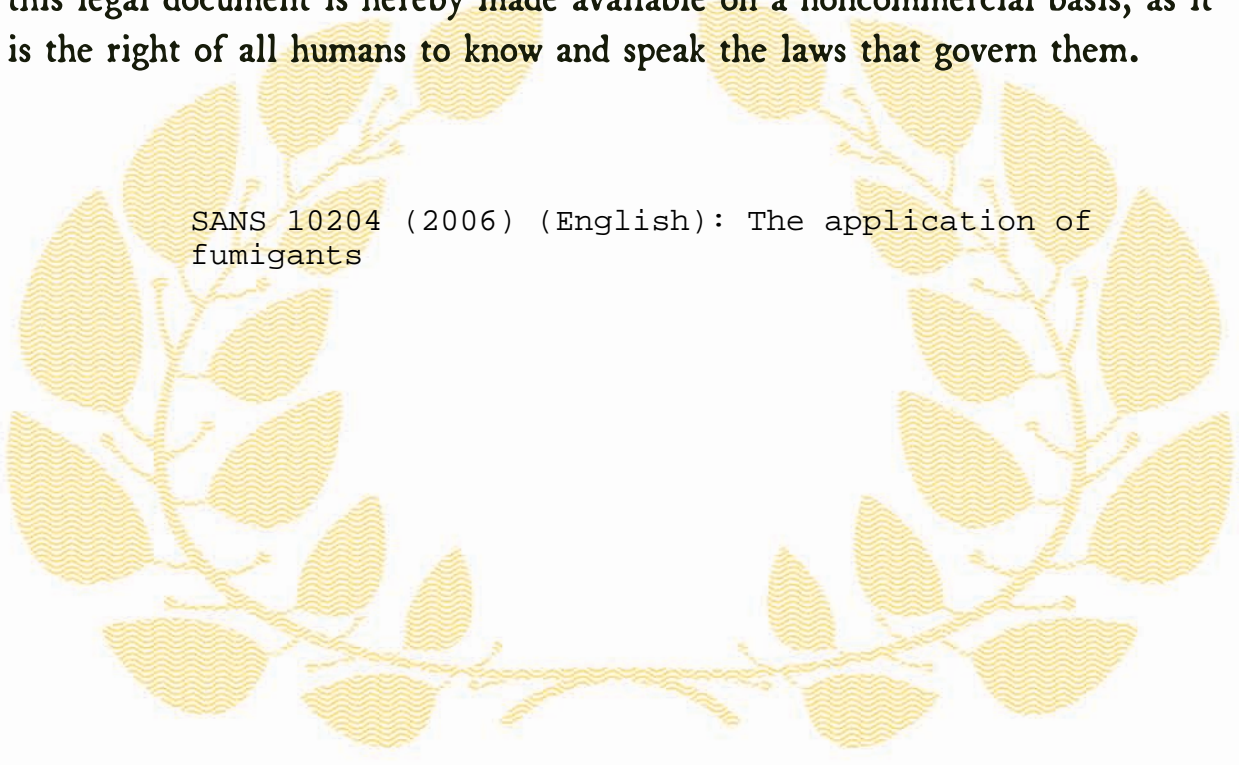




# *Republic of South Africa*

## EDICT OF GOVERNMENT

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SANS 10204 (2006) (English): The application of fumigants



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**SANS 10204:2006**

Edition 2.1

# **SOUTH AFRICAN NATIONAL STANDARD**

## **The application of fumigants**

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# SANS 10204:2006

Edition 2.1

## Table of changes

Change No.	Date	Scope
Amdt 1	2006	Amended to replace SANS 10072 with SANS 10206.

## Abstract

Covers the safe application of fumigants to buildings, bulk transportation vehicles, ships, commodities in storage containers and soil for the control of pests. Training qualifications required of pest control operators, grain silo operators and fumigators are laid down. General preparations before and clearance after fumigation, safety and health precautions and medical and first-aid facilities are covered. Annexes provide information on a basic first-aid kit, the toxicity of fumigants, symptoms of poisoning, and first-aid treatment in cases of suspected poisoning.

## Keywords

emergency measures, emergency treatment, first-aid kits, first aid, fumes, fumigants, fumigation, health and safety requirements, occupational safety, pest control, pesticides, production equipment, protective clothing, railway wagons, residential areas, safety measures, selection, ships, silos, soils, toxicity, training, vacuum processes, warehouses.

## Foreword

This South African standard was approved by National Committee StanSA SC 5140.28B, *Pesticides – Chemical and biological testing and common names – Residual pesticides, fumigants and pesticidal baits*, in accordance with procedures of Standards South Africa, in compliance with annex 3 of the WTO/TBT agreement.

This edition cancels and replaces edition 2 (SANS 10204:2004).

A reference is made in 3.11, 4.1(c) and 7.2.8 to "national regulations and statutory requirements for the registration of a pest control contractor and pest control operator". In South Africa this means registration with the Department of Agriculture in accordance with the Fertilizers, Farm Feeds, Agricultural Remedies and Stock Remedies Act, 1947 (Act No. 36 of 1947).

A reference is made in 4.2(c) to "national regulations and statutory requirements for a grain silo operator". In South Africa this means registration with the Department of Agriculture in accordance with the said Fertilizers, Farm Feeds, Agricultural Remedies and Stock Remedies Act, 1947.

A reference is made in 4.3(c) and 13.3.2.2 to "national regulations and statutory requirements for the registration of a fumigator". In South Africa this means registration with the Department of Agriculture in accordance with the said Fertilizers, Farm Feeds, Agricultural Remedies and Stock Remedies Act, 1947.

A reference is made in 5(a) to "national regulations and statutory requirements for a fumigant". In South Africa this means registration with the Department of Agriculture in accordance with the said Fertilizers, Farm Feeds, Agricultural Remedies and Stock Remedies Act, 1947.

**Foreword** *(concluded)*

A reference is made in 5(c) to "relevant specifications for the registration of a fumigant". In South Africa this means registration with the Department of Agriculture in accordance with the said Fertilizers, Farm Feeds, Agricultural Remedies and Stock Remedies Act, 1947.

A reference is made in 7.1.5 to "national regulations and statutory requirements for the registration of a first-aid kit". In South Africa this means complying with the requirements of the Department of Health.

A vertical line in the margin shows where the text has been technically modified by amendment No. 1.

Annexes A and B form an integral part of this standard.

## **Contents**

	Page
Abstract	
Keywords	
Foreword	
<b>1</b> Scope .....	3
<b>2</b> Normative references .....	3
<b>3</b> Definitions .....	3
<b>4</b> Training of pest control operators, grain silo operators and fumigators .....	5
<b>5</b> Selection of fumigants .....	6
<b>6</b> Application equipment and protective equipment .....	6
<b>7</b> Safety and health precautions .....	8
<b>8</b> General preparations before, and clearance after, fumigation .....	11
<b>9</b> Fumigation of residences .....	14
<b>10</b> Fumigation of warehouses .....	17
<b>11</b> Fumigation of and in ships .....	19
<b>12</b> Fumigation of grain and other unpackaged edible commodities in railway trucks .....	21
<b>13</b> Fumigation by grain silo operators or fumigators of grain and other unpackaged edible commodities stored in silo bins .....	23
<b>14</b> Fumigation by pest control operators of commodities stored in silo bins .....	25
<b>15</b> Fumigation of stacks of packaged grain, oil seeds and legumes by fumigators .....	26
<b>16</b> Fumigation of stacks of packaged grain and other commodities by pest control operators .....	28
<b>17</b> Fumigation of commodities in chambers at atmospheric pressure .....	29
<b>18</b> Vacuum fumigation of commodities .....	30
<b>19</b> Fumigation of soil .....	31
<b>20</b> Fumigation of containers .....	32
<b>Annex A</b> (normative) First-aid kit .....	35
<b>Annex B</b> (normative) The toxicity of fumigants, the symptoms of poisoning, and first-aid treatment in cases of suspected poisoning .....	36

## **The application of fumigants**

### **1 Scope**

This standard covers the safe application of fumigants to buildings, bulk transportation vehicles, ships, commodities in storage, containers and soil.

### **2 Normative references**

The following standards contain provisions which, through reference in this text, constitute provisions of this standard. All standards are subject to revision and, since any reference to a standard is deemed to be a reference to the latest edition of that standard, parties to agreements based on this standard are encouraged to take steps to ensure the use of the most recent editions of the standards indicated below. Information on currently valid national and international standards can be obtained from Standards South Africa.

~~SANS 10072 (SABS 072), *The safe handling of pesticides*.~~

**Amdt 1** |

SANS 10206, *The handling, storage and disposal of pesticides*.

SANS 10304-1 (SABS 0304-1), *The classification of pesticides and stock remedies for sale and handling in South Africa – Part 1: The classification of pesticides*.

### **3 Definitions**

For the purposes of this standard, the relevant definitions given in SANS 10304-1 and the following definitions apply:

#### **3.1**

##### **application rate**

volume in litres, mass in grams, or number of tablets, pellets, discs, plates or sachets of a pesticidal fumigant applied per cubic metre (space fumigation), per square metre (soil fumigation) or per ton (grain in silos)

#### **3.2**

##### **fumigant**

substance or mixture of substances that produces a gas or vapour intended to destroy insects, rodents and certain bacteria, fungi and weeds

#### **3.3**

##### **fumigation**

application of fumigants to pest-infested or (for precautionary purposes) uninfested areas, commodities or soil

# **SANS 10204:2006**

Edition 2.1

## **3.4**

### **fumigation area**

enclosed space where a fumigant is applied

## **3.5**

### **fumigator**

person who applies, or who supervises the application of fumigants to the premises and empty silo bins of his sponsor, and to grain, oil seeds and legumes in silo bins, stacked bags, containers and railway trucks on the premises of his sponsor

## **3.6**

### **gas free**

below the threshold limit value

## **3.7**

### **gasproof sheets**

sheets that enclose the fumigation area, and that are as impervious as possible to the fumigant gas or vapour

## **3.8**

### **gastight**

capable of retaining the molecules of a gas without significant loss of the gas into the surrounding atmosphere

## **3.9**

### **grain silo operator**

#### **GSO**

person who applies, or who supervises the application of fumigants in grain silo bins and, where necessary, to grain in railway trucks and containers on the premises of his sponsor

## **3.10**

### **operation area**

area where the fumigant is handled

## **3.11**

### **pest control contractor**

#### **PCC**

person or organization that is commissioned to apply the fumigant, and that is registered in terms of the national regulations and statutory requirements for the registration of a pest control contractor (see foreword)

## **3.12**

### **pest control operator**

#### **PCO**

person appointed by the PCC to supervise the application of the fumigant, and who takes responsibility during this operation

## **3.13**

### **recommended**

in relation to the application rate of a fumigant, recommended by the manufacturer

NOTE Such recommendations are usually made on the label of each container of the fumigant.

## **3.14**

### **safe**

<fumigation area> gas free



**3.15**

**solid fumigant**

fumigant in the form of tablets, pellets, sachets, plates or discs

**3.16**

**sponsor**

person or organization who commissions the application of the fumigant

**3.17**

**stack**

packed heap of a commodity contained in bags, boxes or other containers

**3.18**

**threshold limit value**

time-weighted average airborne concentration of a fumigant for a normal 8 h workday or 40 h workweek, to which nearly all workers may be repeatedly exposed, day after day, without adverse effect

## **4 Training of pest control operators, grain silo operators and fumigators**

### **4.1 Pest control operator**

A PCO shall have

- a) been trained in the application of fumigants and in first-aid,
- b) at least six months' practical experience in the application of fumigants while in the employment of, and under the direct supervision of, a registered pest control operator, and
- c) obtained a certificate in pest control in terms of the national regulations and statutory requirements for the registration of a pest control operator (see foreword).

### **4.2 Grain silo operator**

A GSO shall

- a) have been trained in the application of fumigants,
- b) have at least six months' practical experience in the application of fumigants while in the employment of, and under the direct supervision of, a pesticides operator registered for fumigation, and
- c) operate in terms of the national regulations and statutory requirements for a grain silo operator (see foreword).

### **4.3 Fumigator**

A fumigator shall

- a) have been trained in the application of fumigants,

- b) have at least six months' practical experience in the application of fumigants while in the employment of, and under the direct supervision of, a pesticides operator registered for fumigation, and
- c) operate in terms of the national regulations and statutory requirements for the registration of a fumigator (see foreword).

## **5 Selection of fumigants**

A fumigant shall

- a) have been registered in accordance with the national regulations and statutory requirements for a fumigant (see foreword),
- b) be used only for the purpose for which it has been registered, as stated on the label, and
- c) comply with the relevant specifications for the registration of a fumigant (see foreword).

## **6 Application equipment and protective equipment**

### **6.1 Application equipment**

**6.1.1** The relevant of the following equipment, appropriate to the type of fumigation that is to be performed and the type of fumigant that is to be applied, shall be used:

- a) **gastight fumigation chamber**, that can be sealed by means of one or two airtight doors. In the case of vacuum fumigation, the chamber shall be evacuated before the introduction of the fumigant;
- b) **gasproof sheets**, that are sound and made of nylon or terylene fabric and coated on both sides with neoprene, or polyvinyl chloride sheets of thickness at least 0,2 mm or any other suitable material;
- c) **plastics-backed adhesive tape**, of thickness at least 0,25 mm;
- d) **sand**, i.e. either loose sand or sand "snakes" (i.e. fabric snakes of diameter at least 150 mm and loosely filled with dry sand);
- e) **gas detectors**, i.e. any suitable instruments, for example, thermal conductivity analysers, interference refractometers, detector tubes, colour indicators, halide lamps, or methyl orange and benzidine copper acetate test papers;
- f) **mechanical applicators**, that are automatically timed, electrically driven, commercially available, and that are used for the application of solid fumigants, for example, to a stream of grain moving to or from a silo bin;
- g) **probes**, that are suitable for the introduction of fumigant tablets into bulk loose commodities, for example, horizontal bulk-stored grain;
- h) **vaporizers**, that are commercially available and that are used to facilitate evaporation of non-flammable liquid fumigants;
- i) **circulating fans**, that are electrically driven, commercially available, and that are used for the even distribution of heavy fumigant gases throughout a fumigation area;

- j) **injection devices**, that are automatically timed, electrically driven, commercially available, and that are capable of being accurately calibrated for the application, at a specific rate, of liquid fumigants to a fumigation area;
- k) **injector guns**, that are commercially available and that are used for the application of liquid fumigants to soil;
- l) **spot fumigant dispenser**, i.e. a commercially available liquid fumigant dispensing device, fitted with a spray nozzle that produces coarse droplets that evaporate under atmospheric conditions of temperature and pressure; and
- m) **total-release pressurized aerosol dispenser**, that is commercially available, filled with an insecticidal fumigant, and that sprays continuously to produce a gas or vapour after a single depression of the actuator.

**6.1.2** Application equipment shall be ventilated after each fumigation operation and before the equipment is placed in a vehicle or returned to storage. All application equipment shall be checked after each fumigation operation, and maintained in a serviceable condition.

Gas cylinders that contain fumigants shall be checked to ensure that their valves are tightly closed, and caps and helmets shall be placed firmly in position before the cylinders are transported or returned to storage.

## **6.2 Protective equipment**

### **6.2.1 Protective clothing and devices**

#### **6.2.1.1 General**

The PCO and his workers (and the fumigator or GSO, where relevant) shall understand clearly that, even though protective clothing is worn and respiratory protection provided, great care shall still be taken in the handling of fumigants. The PCC or employer of the GSO or fumigator shall provide the washable protective clothing and devices described in 6.2.1.2 and 6.2.1.3.

#### **6.2.1.2 Clothing**

For reasons of both comfort and safety, protective clothing in accordance with SANS 10206 ~~SANS 10072~~, or other suitable cotton garments shall be worn. Boots or soft-soled shoes and gloves (that extend to at least 75 mm above the wrists) shall be impermeable. Trousers shall be worn over boots.

**Amdt 1**

Concentrated fumigant vapour shall not be trapped inside the gloves or boots. Gloves and boots worn when using methyl bromide fumigants shall not be of rubber.

#### **6.2.1.3 Gas masks and canisters**

Gas masks shall form an airtight seal with the face, and canisters shall be readily replaceable. Each canister shall bear a permanent label that gives the date of expiry in indelible marking, and contains a space where the user shall enter the date of commencement of the canister's use and the length of time for which it was used. The canisters of effective industrial gas masks shall be of the filter type. Closed-circuit breathing apparatuses that are independent of the ambient atmosphere, are vital in certain types of fumigation, and shall always be available for emergency rescue use.

The recommended type of canister shall be used when a specific fumigant is being handled.

As industrial gas masks are not effective at high fumigant concentrations, closed-circuit breathing apparatuses shall be used when the fumigant concentration in the air exceeds 20 mL/L in the case of methyl bromide and 5 mL/L in the case of phosphine.

### **6.2.2 Maintenance of protective equipment**

Gas masks and protective clothing shall be maintained in a serviceable condition, and spare canisters shall be available. Clean protective clothing, used protective clothing and the workers' personal clothing shall be kept apart from one another. All protective clothing shall be aired at the end of each day. If a worker's clothing becomes soiled with fumigant during the course of a day's work, it shall be replaced immediately with clean clothing, and the soiled clothing shall be aired and washed at the end of the day. Canisters shall be replaced as recommended by the manufacturer, and as indicated by the expiry date. Before a canister is attached to a gas mask, the seal on the gas mask shall be checked to ensure that it is intact. Expired canisters shall be punctured and discarded.

During the cleaning of equipment and protective clothing, contamination of all sources of drinking water shall be prevented.

NOTE Commercially available detector tubes, with a low range of detection for the specific gas and that can be connected to the used canister and to a suction tube, are recommended.

## **7 Safety and health precautions**

### **7.1 Safety precautions**

#### **7.1.1 General**

A fumigant shall not be used for any purpose other than that recommended on the label (see clause 5). The contents of the original container shall not be repacked into small, unlabelled containers, and the label of a container shall not be removed or obscured. The warnings and precautions set out on the label shall always be observed. The PCO or the fumigator or the GSO (as relevant) shall ensure that fumigated areas are not entered or occupied before he is satisfied that the premises are gas free.

The PCC or the responsible officer employed by the co-operative or the milling plant or the agent of the relevant control board (as applicable) shall make provision for the safe storage, under lock and key, of all fumigants, and he shall exercise strict control over the movement of fumigants to and from the store (see also 6.1.2). Empty containers shall be safely disposed of or recycled, in accordance with SANS 10206.

#### **7.1.2 Transportation of fumigants**

The equipment-carrying area of the vehicle shall be lockable and shall be sealed off from the cab. Suitable pictograms, of size at least 250 mm × 250 mm, with a white background and showing the skull-and-crossbones sign and the words "Poisonous gas" in black capital letters, shall be affixed to the vehicle. Emergency telephone numbers shall be clearly indicated on the vehicle.

#### **7.1.3 Training and supervision of workers**

In addition to ensuring that each of his PCOs (or GSOs and fumigators, where relevant) is fully qualified (see clause 4) and has a practical knowledge both of the symptoms of poisoning by the fumigants to be used and of the appropriate first-aid measures, a PCC, or the responsible officer employed by the co-operative or the milling plant or the agent of the relevant control board (as applicable), shall ensure that all workers receive practical training, and that no worker is allowed to

apply fumigants unless he is familiar with the risks involved and the precautions to be taken. To ensure that workers receive immediate attention in case of poisoning, they shall not be allowed to work alone. Furthermore, a worker shall not be permitted to spend more than 10 h/d on the application of fumigants, and during this workday period there shall be at least two breaks, each of at least 30 min duration.

#### **7.1.4 Medical facilities**

The PCO or the fumigator or the GSO (as relevant) shall be familiar with the location of the nearest medical facility.

#### **7.1.5 First-aid equipment**

A first-aid kit (see also annex A) that complies with the national regulations and statutory requirements for the registration of a first-aid kit (see foreword), shall be readily available at all times. At least two members of each team of the PCO, and at least one member of each team employed by co-operative depots for handling grain, oil seeds and legumes, shall be trained to apply first-aid treatment with particular reference to the hazards likely to be encountered (see annex B). In addition to the first-aid kit, a PCO shall have available a supply of medical grade oxygen and a suitable mask, and a manual respiratory resuscitating device.

#### **7.1.6 Antidotes**

Antidotal tablets or injections for the treatment of cases of poisoning by the chemical(s) that is(are) handled shall be available at all times and shall be carried in a separate, sealed package, and the nature of the antidotes and information about their administration shall be clearly marked. An appropriately qualified person shall administer antidotal injections as soon as the cause of poisoning has been confirmed. The package containing the antidote, together with the worker's works-exposure record card (see 7.2.8) and the label of the fumigant concerned, shall be handed to the person treating the case of poisoning.

First-aid treatment shall be given immediately by a qualified first-aider.

### **7.2 Health precautions**

**7.2.1** Only workers who have been medically examined and found fit for work where exposure to fumigants is involved, shall be employed.

**7.2.2** Workers shall not be allowed to eat, drink or smoke in an operation area. No intoxicated person shall be allowed to take part in the fumigation operation as symptoms of poisoning are often misinterpreted as abuse of alcohol. Gloved hands shall be washed, then masks shall be removed and, finally, gloves shall be removed. Workers shall wash their hands thoroughly before eating, drinking, smoking or using the lavatory.

**7.2.3** Workers shall remove all their protective clothing at the end of each day or operation. In addition, whenever a worker becomes grossly contaminated, even if operations are incomplete, he shall be made to remove all protective clothing immediately, to soap, wash and rinse himself thoroughly, and to don clean protective clothing before continuing operations.

**7.2.4** A worker shall not wear any used protective equipment that has not yet been thoroughly ventilated.

**7.2.5** Soap, clean towels and clean water shall be available near the operations area, but sufficiently isolated to avoid any contamination. Care shall be taken to ensure that there is no interchange of towels between workers.

**7.2.6** Wherever possible, running water shall be used for washing. Alternatively, each worker shall be supplied with a clearly marked container of water for washing at the end of each day's operations or whenever grossly contaminated. The problem of pollution caused by contaminated running water shall be taken into account.

**7.2.7** The PCO or the fumigator or the GSO (as relevant) shall ensure, by frequent atmospheric monitoring (see 6.1.1(e)), that workers are not exposed to fumigant vapours and that if the fumigant comes into contact with any part of a worker's skin, the affected part is washed immediately with soap and water, except in the case of phosphine-producing solids, where the solids shall be brushed off before washing.

**7.2.8** Subject to any restriction or further requirement laid down by the national regulations and statutory requirements for the registration of a PCO (see foreword), a works-exposure record card shall be kept by the PCC or the responsible officer employed by the co-operative or the milling plant or the agent of the relevant control board (as applicable) for each worker engaged in the application of fumigants. The card shall provide the appropriate of the following details:

- a) the name and address of the worker;
- b) the dates on which fumigants were handled;
- c) the common name or chemical name of the active ingredient(s) and physical state of the fumigant(s) involved;
- d) the fullest possible details of any occupational accident, including non-injury occurrences;
- e) the date, duration and nature of each poisoning; and
- f) the medical practitioner's notes for each visit, which include, inter alia, the doctor's name, the date of examination and, when relevant, the date of suspension from work and the date of resumption of duty.

**7.2.9** The PCC or the responsible officer employed by the co-operative or the milling plant or the agent of the relevant control board (as applicable) shall ensure that the following measures are strictly adhered to:

- a) Each worker shall undergo one full medical examination annually.
- b) Each worker shall, when he first assumes duty, undergo a blood test to determine his cholinesterase baseline level. Thereafter, if he is engaged in handling organophosphate or carbamate pesticides (or both), he shall undergo routine tests to determine his blood cholinesterase activity. If it has fallen to a level in one of the following ranges, the corresponding actions shall be taken:
  - 1) 100 % to 75 % of normal: Repeat the test after 48 h.
  - 2) 75 % to 50 % of normal: Repeat the test within 48 h. If the result is confirmed, the worker shall be suspended from handling organophosphate and carbamate pesticides for two weeks and shall then be retested regularly (for example, every two days) until his cholinesterase baseline level is reached.

- 3) 50 % to 25 % of normal: Repeat the test within 48 h. If the result is confirmed, the worker shall be suspended from handling **ALL** pesticides and shall be retested regularly (for example, every two days) at the discretion of the medical practitioner.
- 4) Below 25 % of normal: Repeat the test within 48 h. If the result is confirmed, the worker shall be suspended from all work and the medical practitioner shall be consulted. A worker who has been suspended from carrying out any duty, shall be permitted to resume such duty only with the approval of the medical practitioner.

NOTE Cognizance should be taken of other cholinesterase inhibitors, diet pattern, etc.

- c) Blood samples of workers engaged in handling fumigants containing bromide shall be taken quarterly to determine bromide levels.
- d) Each worker shall be checked bi-annually for the possibility of burst eardrums.
- e) A worker shall not be allowed to take part in fumigation operations while he is suffering from any clinical complaint or stomach ailment, or if he has burst eardrums.
- f) If any symptom or combination of symptoms of illness or discomfort becomes apparent, for example, headache, dizziness, vomiting, diarrhoea, unusual neuro-psychiatric behaviour, and tightness of the chest, the worker shall be suspended from work without delay, and a medical practitioner shall be consulted immediately.
- g) In the event of an illness or accident, the worker's works-exposure record card and, in the case of a suspected poisoning, the label or at least the name of the active ingredient of the fumigant involved, shall be handed to the medical practitioner in attendance.
- h) No worker who, on medical grounds, has been advised to abstain from working with one type of fumigant shall be allowed to work with another type of fumigant without the prior approval (endorsed on the worker's works-exposure record card) of a medical practitioner.
- i) No worker shall be allowed to drink alcohol or smoke during fumigation operations.

## **8 General preparations before, and clearance after, fumigation**

### **8.1 Notification of authorities and persons concerned**

**8.1.1** A PCO who intends to fumigate a building or other enclosed space shall deliver the prescribed notice (see 8.1.2) of such an intention, in writing and in sufficient time before fumigation operations are commenced,

- a) to the appropriate authorities, for example the Department of Health, the police and the fire brigade (see also 8.2.3(g)), and
- b) in duplicate to every tenant or occupier within the fumigation area or the risk area (i.e. in buildings abutting on the area) or, in the case of a vessel, the master or other person in charge of the vessel or, in the case of a container, the owner and the transport contractor, all of whom shall acknowledge receipt of the notice by signing the duplicate copy for retention by the PCO.

NOTE The above notification is unnecessary when fumigation of grain silo bins and commodities in stacks or in railway trucks or in containers is done by grain silo operators and fumigators employed by the co-operative or the milling plant or the agent of the relevant control board on the premises of their employers.

**8.1.2** The notification of intended fumigation shall read as follows:

To .....	
Please note that it is my intention to fumigate .....	
.....	
for the following purpose .....	
.....	
by means of .....	
(registered name and number of fumigant.....	
.....	
on ..... commencing at ..... : .....	
.....	
The undersigned assumes full responsibility for precautions to be taken before, during and after operations	
Signature .....	Date .....
(Pest Control Operator)	
You are required to acknowledge receipt of this notice by signing the duplicate hereof	
Signature .....	Date .....
(Occupant or Responsible Officer)	

**8.2 Preparation of a fumigation area**

**8.2.1** The fumigation area shall be carefully sealed with material that is as impervious as possible to the fumigant to be used. The fumigation area and all areas adjacent to it into which the fumigant gas might possibly penetrate, shall be evacuated. The PCO or the fumigator or the GSO (as relevant) shall take possession of all keys to the entrances to these areas for the duration of the fumigation period.

**8.2.2** Before the fumigation procedures start, the PCO or the fumigator or the GSO (as relevant) shall post warning notices on doors and other means of access to the fumigation and risk areas. The notices shall have a white background with the warning **"DANGER, KEEP OUT"**, followed by **"FUMIGATION WITH..."** (name of fumigant) printed in capital letters, of height at least 100 mm, in a colour that is a clear contrast to the background. The names and telephone numbers of the PCO and PCC contractor or of the responsible officer employed by the co-operative or the milling plant or the agent of the relevant control board (as applicable) shall be clearly shown in block letters, and the relevant treatment or course of action in case of accidental poisoning shall be given at the foot



of the notice. At night, warning notices shall be illuminated and a security watchman shall be on duty.

**8.2.3** The fumigation operation shall not commence until the PCO or the fumigator or the GSO (as relevant) has, by personal inspection, ascertained that

- a) the fumigation and risk areas have been vacated,
- b) all fires and naked flames within the fumigation area have been extinguished and all oil, gas and electricity supplies have been turned off,
- c) all liquids (including water), open foods and goods that are liable to absorb the particular fumigant have been removed from the fumigation area,
- d) all cracks, crevices and openings in or between walls and ceilings or roofs and floors, and all fireplaces in the building, vessel or other enclosed space about to be fumigated have been so sealed as to prevent the escape of fumigant gases from the fumigation area,
- e) the required fans are in position and have been tested for efficiency,
- f) the nearest telephone outside the fumigation area has been located and the number noted, and
- g) it has been confirmed that notice has been given to the relevant authorities (see 8.1.1(a)) that fumigation is about to commence.

NOTE The instruction given in 8.2.3(g) is not applicable to GSOs and fumigators employed by co-operative grain, oil seeds and legume handling depots.

### **8.3 Clearance of a fumigation area**

At the conclusion of the fumigation operation and after the fumigation area has been declared safe for re-occupation, i.e. when tests show that the area is gas free, the PCO shall deliver a clearance notice in writing, in the case of

- a) a building or enclosed space, to every occupier or tenant,
- b) a vessel, to the master or other person in charge, and
- c) containers, to the owner and the transport contractor.

### **8.4 Record of a fumigation operation**

The PCO shall keep a record of each fumigation operation that is completed, and the record shall include the following:

- a) the name and address of the sponsor;
- b) the address of the fumigation area;
- c) the fumigant used, the type of application and the dosage;
- d) the date and commencing time of the fumigation operation;
- e) the clearance time; and
- f) copies of all notices submitted.

This information shall be retained for two years for examination, upon request, by the relevant authorities (see 8.1.1(a)).

## **9 Fumigation of residences**

### **9.1 Notification**

Notification of the intention to fumigate a residence shall be given as described in 8.1.

### **9.2 Safety and health precautions**

The PCO shall ensure that all the workers are aware of the relevant provisions of clause 7 and the information given in annex B.

### **9.3 Preparation of the fumigation area**

**9.3.1** The PCO shall arrange with the occupant(s) a suitable time to vacate the residence before fumigation, and provide an approximate time to return after the fumigation. The PCO shall keep a record of the occupant(s) whereabouts and telephone number(s) during the fumigation, and shall observe all the relevant provisions of 8.2.

**9.3.2** The PCO shall provide the occupant(s) with a written list of materials and articles that shall be removed before fumigation is commenced, for example:

- a) all foods not sealed in metal containers;
- b) pets, fish in tanks;
- c) pot plants;
- d) items that contain foam and sponge rubber, for example, yoga mats, foam-backed coats and foam cushions;
- e) pillows;
- f) Persian, Chinese and other valuable carpets, and thick-pile shaggy carpets;
- g) chemicals used in photographic processing or in other hobbies;
- h) furs and kid leather articles;
- i) plastics headphones;
- j) building blueprints;
- k) garments that consist of man-made fibres; and
- l) shrubs and flowers that are within 1 m from the outside walls.

**NOTE** Foam or rubber-backed carpeting may be left in the fumigation area at the discretion and risk of the owner, who should have been enlightened regarding the potentially malodorous effects of the fumigant. Similarly, owners should be advised to remove artwork to preclude it from being damaged by any aftereffects of the fumigation process, for example, moisture condensation.

**9.3.3** The roofing material and its condition shall be checked and, if necessary, a written exemption from responsibility for possible damage incurred as a result of the fumigation work shall be obtained from the occupant(s).

**9.3.4** The residence to be fumigated shall be inspected to ensure that there are no connecting buildings or other attached structures that would make it impossible to completely cover the residence with gasproof sheets. The area shall be checked for tunnels, drains, piping systems, vents, etc., that lead to other buildings and these openings shall be sealed.

**9.3.5** If the residence is supplied from a main gas line, the gas shall be turned off at the main shut-off valve. The gas system shall then be stabilized by igniting the gas at one appliance and checking all appliances to ensure that this results in every pilot flame being extinguished.

**9.3.6** Food freezers and refrigerators shall be sealed properly around the doors and lids with plastics-backed adhesive tape (see 6.1.1(c)) and their drains, if present, shall also be sealed.

**9.3.7** No appliances shall be left in operation.

**9.3.8** Where applicable, fumigant release hoses shall be installed inside the building, in areas selected for good initial dispersion of the fumigant and, unless vaporizing nozzles have been inserted in the hoses, the ends of the hoses shall be so placed in vaporizing trays as to prevent damage to floors and fabrics.

**9.3.9** Fans to circulate the gas or vapour shall be so placed in the building that an even distribution is reached in a short time after release of the fumigant.

NOTE The size and number of the fans depend on the volume to be fumigated, for example, a fan with a capacity of about 16 m<sup>3</sup>/min is adequate for 2 200 m<sup>3</sup> of space.

**9.3.10** Sharp corners, edges and projections on the roof shall be so padded as to prevent damage to the gasproof sheets (see 6.1.1(b)).

**9.3.11** A space of width at least 300 mm from the base of the exterior of the residence shall be so cleared and flattened that the gasproof sheets can be sealed against the flattened surface to prevent loss of the fumigant.

**9.3.12** When placing the gasproof sheets in position, workers shall wear soft-soled shoes and exercise extreme caution when walking on wet roofs and the gasproof sheets. Workers shall wear a safety belt and rope when working on steep-pitched or fragile roofs. Roof ladders may be used as an added precaution against roofs being damaged, and metal or wet ladders shall not be allowed to touch electric wiring.

**9.3.13** Gasproof sheets, each so folded with ends to the middle until a long narrow strip (snake) is obtained, shall be hoisted to the top of the roof and allowed to unfold down the opposite sides of the building simultaneously. At least 1 m of the gasproof sheet shall be allowed to extend beyond the walls onto the ground. Where more than one sheet is used in a fumigation, a 1 m width of the edge of the first sheet shall be folded back and the second sheet shall be so laid on the first that the edge of the second sheet overlaps and coincides with the folded-back edge of the first sheet. The overlapped edges shall then be rolled together and the roll secured with G-clamps and battens.

**9.3.14** At ground level, the gasproof sheets shall be sealed by weighting them down with sand "snakes" or loose sand (see 6.1.1(d)). The corners of the sheets shall be folded flat and extra sealing material shall be used to hold the corners down.

**9.3.15** Where the gasproof sheets are loose or slack, such as at corners and on roofs, they shall be rolled or clamped or made into false or dart-type seams.

**9.3.16** All except one of the entrances through the gasproof sheets shall be sealed, and a guard shall be posted at this entrance to ensure that no person other than the PCO enters during the final inspection. The PCO shall move systematically from room to room

- a) to confirm compliance with the provisions of 9.3.1, 9.3.2, 9.3.5, 9.3.6, 9.3.8 and 9.3.9, and
- b) to open all doors (including outside doors), windows and drawers to ensure good circulation of the fumigant.

The last entrance through the gasproof sheets shall be sealed upon completion of the inspection.

**9.3.17** The PCO shall check the exterior of the sheeted residence to ensure that the gasproof sheets are properly sealed and in good condition, that warning notices as described in 8.2.2 have been posted, and that a guard remains on duty throughout the entire fumigation operation.

## **9.4 Application of a gaseous fumigant**

**9.4.1** The circulating fans shall be turned on before the fumigant is released.

**9.4.2** The manufacturer's instructions shall be followed with regard to calculating the mass of fumigant to be released. Where possible and applicable, hoses shall be used to release the fumigant inside the fumigation area.

**9.4.3** The PCO shall connect the compressor via an air pressure meter to the air inlet valve on the gas cylinder. The gas outlet from the cylinder shall be connected to the main pipeline leading to the fumigation area via a gas pressure meter with a Schröder valve and a second valve in the main pipeline. All connections shall be of the male and female type and shall be checked to ensure that they are gastight.

The gas cylinder shall be placed on a scale and its gross mass noted. The gas supply system shall be carefully operated, using the following steps:

- a) Open the gas outlet valve on the cylinder until the gas pressure meter stabilizes. Then slowly open the second valve in the main gas outlet pipeline.
- b) Note the pressure on the gas pressure meter. If it is lower than the pressure registered on the air pressure meter (while the compressor is in operation), slowly open the air inlet valve on the gas cylinder.
- c) Regulate the pressure constantly.
- d) When only another 5 kg of gas is needed, close the air inlet valve on the cylinder (to ensure that the cylinder is not under high pressure at the completion of the application procedure).
- e) Close the gas outlet valve on the cylinder as soon as enough gas has been applied.
- f) Leave the gas supply system undisturbed until the gas pressure meter registers zero. Then close the second valve in the main gas supply pipeline and remove the cap on the Schröder valve at the gas pressure meter. Next, connect the compressor to the Schröder valve, slowly open the second valve in the main gas supply pipeline, and leave it open for a period of 5 min to 10 min to clear the pipe system of gas. After this period, close all valves and disconnect the pipes. Then close off the main pipeline to the fumigation area, remove all couplings from the gas cylinder and replace its protective cap.

**9.4.4** Fumigant concentrations inside the fumigation area shall be monitored and the possible presence of leaks tested with an appropriate gas detector (see 6.1.1(e)). Any leaks shall be sealed immediately.

**9.4.5** The building shall be fumigated for the required exposure period recommended by the manufacturer.

## **9.5 Clearance after fumigation**

**9.5.1** Ventilation after completion of the fumigation shall be expedited. The sand or sand "snakes" shall be removed, the gasproof sheets shall be pulled clear of any shrubs and flowers, and efficient ventilation shall be ensured by allowing the sheets to sag.

**9.5.2** After initial ventilation, two workers, remaining together and wearing protective equipment, shall place fans in basements and other areas that cannot be cleared of gas by the opening of doors and windows.

**9.5.3** The gasproof sheets shall be removed from the building and properly folded, rolled and tied. All padding, sandbags, ropes, battens and clamps shall be removed from the roof.

**9.5.4** The building shall be checked for any damage caused during the fumigation, and a written report shall be made to the owner.

**9.5.5** A gas detector (see 6.1.1(e)) shall be used to check whether the residence is safe for re-occupancy. Occupants should be requested to keep as many doors and windows as possible open for at least a further 24 h.

**9.5.6** Any dead rodents shall be removed from the building.

**9.5.7** Refrigerators and freezers shall be unsealed and checked to ensure that they are operating properly. When relevant, the gas shall be turned on and all pilot lights re-ignited.

**9.5.8** All fumigation equipment and warning signs shall be removed from the premises.

**9.5.9** Clearance notice(s) (see 8.3) shall be issued and all pertinent data of the fumigation operation (see 8.4) shall be recorded.

## **10 Fumigation of warehouses**

### **10.1 General**

If a building cannot be made gastight by sealing it, dichlorvos shall be used.

**NOTE** Sprayable vinyl plastics coatings may be used to render buildings, for example, tobacco warehouses, impermeable to gas.

### **10.2 Notification**

**10.2.1** The PCO or the fumigator shall arrange with the manager or owner of the warehouse a suitable time for the fumigation operation and provide him with an approximate time for clearance after the fumigation operation.

**10.2.2** Notification of the intention to fumigate a warehouse shall be given as described in 8.1. The PCO or the fumigator shall have readily accessible the address and telephone number of the manager or owner of the warehouse during the fumigation operation.

### **10.3 Safety and health precautions**

The PCO or the fumigator shall ensure that all the workers are aware of the relevant provisions of clause 7 and the information given in annex B.

### **10.4 Preparation of the fumigation area**

**10.4.1** The PCO or the fumigator shall observe the relevant provisions of 8.2.

**10.4.2** The building shall be made gastight by sealing all cracks, crevices and holes around closed windows, doors and ventilators. Cracks, holes and ventilators shall be sealed, either with gasproof sheets (see 6.1.1(b)) secured with heavy-duty masking tape or with plastics-backed adhesive tape (see 6.1.1(c)) or, except in the case of ventilators, by using a commercially available vinyl plastics sealing compound that can be sprayed over holes, cracks and crevices.

**10.4.3** Where applicable, fumigant release hoses and fans shall be installed as described in 9.3.8 and 9.3.9, respectively.

**10.4.4** Where possible, large stacks of goods in the warehouse shall be separated into smaller stacks (to facilitate penetration of the fumigant gases).

**10.4.5** All except one of the entrances to the warehouse shall be sealed and a guard shall be posted at this entrance to ensure that no person other than the PCO or the fumigator enters the warehouse during the final inspection.

**10.4.6** The PCO or the fumigator shall move systematically through the warehouse to confirm compliance with the provisions of 10.4.1 to 10.4.5 (inclusive). The PCO or the fumigator shall also check the exterior of the building to ensure that it is properly sealed and that warning notices as described in 8.2.2 have been posted.

**10.4.7** When the fumigant is applied in the gaseous form, the last entrance to the warehouse shall be sealed upon completion of the inspection. When solid fumigant is used, the final sealing shall be in accordance with 10.5.2.

### **10.5 Application of the gaseous fumigant**

**10.5.1** The circulating fans shall be turned on before a gaseous fumigant is released.

**10.5.2** The manufacturer's instructions shall be followed in calculating the mass of gaseous fumigant to be released or the amount of solid fumigant to be applied. When solid fumigants are used, they shall be placed on trays or on plastics sheets to facilitate the cleaning up of residual powders after completion of the fumigation. When gaseous fumigants are used, they shall be released, in accordance with 9.4.3, from outside the fumigation area through hoses into the sealed warehouse.

In the case of solid fumigants, the remaining entrance to the warehouse shall be sealed after workers have distributed the required amount of fumigant and after the PCO or the fumigator has checked that all the workers have vacated the warehouse.

**10.5.3** Fumigant concentrations inside the warehouse shall be monitored and the possible presence of leaks tested with an appropriate gas detector (see 6.1.1(e)). Any leaks shall be sealed immediately.

**10.5.4** The building shall be fumigated for the required exposure period recommended by the manufacturer.

## **10.6 Clearance after fumigation**

**10.6.1** Ventilation after completion of the fumigation shall be expedited.

**10.6.2** A gas detector (see 6.1.1(e)) shall be used to check whether the air in the warehouse is safe, and ventilation shall continue until the warehouse is safe.

**10.6.3** All fumigation equipment, residues of solid fumigants, and warning notices shall be removed from the premises.

**10.6.4** Clearance notices (see 8.3) shall be issued by the PCO and all pertinent data of the fumigation operation (see 8.4) recorded.

## **11 Fumigation of and in ships**

### **11.1 Initial inspection and notification**

**11.1.1** The PCO shall (if requested to do so by the ship's agent) inspect the ship or the imported commodity in the hold(s) to establish the type of infestation, which holds are to be fumigated and their capacity. He shall then arrange a suitable time for the fumigation operation with the captain or master of the ship and provide him with an approximate time for clearance after the fumigation operation.

**11.1.2** Notification of the intention to fumigate the ship shall be given as described in 8.1. The PCO shall have readily accessible the address and telephone number of the captain or master of the ship during the fumigation period.

### **11.2 Safety and health precautions**

The PCO shall ensure that all the workers are aware of the relevant provisions of clause 7 and the information given in annex B.

A sufficient number of gas masks and canisters shall be kept ready, at the top of the gang plank, for use by the crew members in an emergency and when hatches are opened for ventilation.

### **11.3 Preparation of the fumigation area**

**11.3.1** The PCO shall observe the relevant provisions set out in 8.2.

**11.3.2** The PCO shall take readings of the temperature in the holds to be fumigated.

**11.3.3** The PCO shall determine whether the ship is fitted with smoke detecting and automatic fire-extinguishing equipment and shall make the appropriate arrangements. All refrigeration and air-conditioning compressors shall be checked for leaks.

NOTE Freon may be detected by means of a halide lamp, and ammonia may be detected by means of pink litmus paper.

**11.3.4** Bilges forward and aft in each hold to be fumigated and, where necessary, hatches to lower holds, shall be opened.

**11.3.5** The relevant release hoses, sampling tubes and fans shall be placed in position. All openings (except those through which the fumigant will be released) to the hold, for example, hatch covers, ventilators, stump masts, cowls, and any possible places where leakage to the engine room, crew's quarters, storerooms, etc. may occur, shall be sealed, using effective sealing materials such as plastics-backed adhesive tape (see 6.1.1(c)) and gasproof sheets (see 6.1.1(b)) to cover wooden or pontoon hatches. All portholes and doors to crew accommodation shall be closed and sealed.

**11.3.6** The PCO shall inspect the whole ship systematically to ensure that the ship's crew and all pets have vacated the ship and to confirm compliance with the provisions of 11.3.1 to 11.3.5 (inclusive). Quarantine facilities shall be made available at the harbour for any animals that might be on the ship. If such facilities are not available, animals shall be secured on deck. The PCO shall post a guard at the gangway to keep unauthorized persons off the ship. The PCO shall also check that the warning notices described in 8.2.2 have been posted.

## **11.4 Application of the gaseous fumigant**

**11.4.1** Only gaseous fumigants shall be used, and the manufacturer's instructions with regard to calculating the fumigant dosage shall be followed, taking into account the temperature in the hold.

**11.4.2** In the case of an empty hold, or of an infested imported commodity in a hold, the circulating fans shall be started and the gaseous fumigants shall be released in accordance with 9.4.3, from outside the sealed hold through hoses into the hold. Fans shall be operated for at least 30 min after release of the fumigants.

**11.4.3** Fumigant concentrations inside the hold shall be monitored and the possible presence of leaks tested with an appropriate gas detector (see 6.1.1(e)). Any leaks shall be sealed immediately.

**11.4.4** The hold shall be fumigated for the required exposure period recommended by the manufacturer.

## **11.5 Clearance after fumigation**

**11.5.1** Ventilation after completion of the fumigation shall be expedited.

NOTE 1 Methyl bromide is a heavy gas and requires extensive ventilation.

NOTE 2 Hatches should be opened in sequence, working upwind. Crew members who open the hatches under the responsibility and supervision of the PCO should wear the gas masks kept for this purpose at the top of the gang plank.

**11.5.2** A gas detector shall be used to check whether the air in the ship is safe, and ventilation shall continue until the ship is safe.



**11.5.3** Clearance notices (see 8.3) shall be issued and all pertinent data of the fumigation operation (see 8.4) shall be recorded.

**11.5.4** All fumigation equipment, warning notices, etc., shall be removed from the ship.

## **12 Fumigation of grain and other unpackaged edible commodities in railway trucks<sup>1)</sup>**

### **12.1 Conditions**

**12.1.1** When groundnuts (infested or not) or any other edible commodity that is found to be infested by insects are to be loaded into trucks on the premises of a co-operative, fumigation shall be undertaken by the fumigator or the GSO of the co-operative.

**12.1.2** If infestation of an edible commodity intended for export is discovered at the time of arrival of the trucks at the harbour premises, fumigation shall be arranged by the relevant officer of the relevant control board.

**12.1.3** If the fumigant is applied to filled trucks on the harbour premises, the trucks shall be moved to a safe siding and sealed with gasproof sheets. Warning notices shall be posted (see 8.2.2) and the trucks shall be fumigated with methyl bromide in accordance with the relevant provisions of 12.5.

### **12.2 Notification**

When the provisions of 12.1.1 apply and the commodity is to be fumigated by a PCO, notification of intention to fumigate a railway truck shall be given as described in 8.1.

### **12.3 Safety and health precautions**

The PCO or the GSO or the fumigator (as relevant) shall ensure that all the workers are aware of the relevant provisions of clause 7 and the information given in annex B.

### **12.4 Preparation of the fumigation area**

**12.4.1** The inside of each empty truck shall be examined by the PCO or the GSO or the fumigator (as relevant) to ensure that it is clean and dry and that the off-loading valves are properly closed. Any openings (other than the loading hatches) through which the gas can escape shall be sealed on the inside with plastics-backed adhesive tape.

**12.4.2** The truck(s) shall be pushed into position and all the loading hatches opened. The PCO or the GSO or the fumigator (as relevant) shall also check that the warning notice(s) described in 8.2.2 have been posted on the relevant truck(s).

### **12.5 Application of the solid fumigant**

**12.5.1** The manufacturer's instructions shall be followed with regard to calculating the amount of solid fumigant to be applied.

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1) For fumigation of packaged commodities see clauses 15, 16 and 17.

**12.5.2** The fumigant shall be distributed in the truck to be loaded, and loading of the infested commodity shall start immediately thereafter. Any delay between the application of the fumigant and the loading of the commodity shall not exceed a few minutes.

**12.5.3** The hatches of the truck shall be closed immediately after completion of the loading operation.

**12.5.4** The PCO or the GSO or the fumigator (as relevant) shall stipulate on the warning notice(s) (see 12.4.2) the date of fumigation, the place, the time of application, the fumigant and the dosage.

**12.5.5** If there is any delay in, or interruption with, the loading, the loading hatches shall be covered with gasproof sheets (see 6.1.1(b)) and then closed. As soon as loading can be started or resumed (as applicable), the PCO or the GSO or the fumigator (as relevant), wearing a suitable gas mask, shall open only those hatches immediately required for loading, and reclose them after loading.

**12.5.6** A suitable pictogram with the words **"UNDER FUMIGATION: DO NOT OPEN"** and indicating the type of fumigant used and the date and time of fumigation shall be affixed to the side of each truck under fumigation.

**12.5.7** When methyl bromide fumigants have been used, the trucks shall be moved to a safe siding and left for the specified fumigation period (as recommended by the manufacturer), before being ventilated for at least 30 min and then sent to their destination. When phosphine-releasing solid fumigants have been used, the despatch of the trucks shall be so timed (in consultation with the rail authorities) that they do not arrive at their destination until after the specified fumigation period has expired.

**12.5.8** Fumigated trucks from a specific silo bin or station shall preferably be hauled under unit control. Before the departure of the trucks, the PCO or the GSO or the fumigator (as relevant) shall notify the responsible officer (of the rail authority) that fumigation procedures have been completed and give the relevant truck number(s) and, when the fumigant is a phosphine-releasing solid, the expiry date of the fumigation period. The officer shall then transmit this information and the train number(s) to the responsible officer at the port concerned.

**12.5.9** Fumigated trucks shall not be opened en route.

## **12.6 Defective trucks and railway accidents**

**12.6.1** If a truck under fumigation becomes defective, approval shall be obtained from the responsible officer before the truck is taken to the workshop and repaired. The repair depot concerned shall contact the health officer, who shall then check for the presence of dangerous concentrations of gas before work is commenced on the truck. The health officer shall be in attendance when the trucks are unloaded and reloaded. Workers shall wear suitable gas masks. Reloaded trucks shall be regarded as trucks under fumigation.

**12.6.2** Derailed trucks shall not be rerailled before the relevant officers have been informed. The trucks shall be guarded and the relevant officer shall take up his position on the windward side of the truck. If it is necessary to reduce the load in order to rerail a truck, the loading hatches shall be opened and the trucks aired for at least 30 min. Thereafter gasproof sheets (see 6.1.1(b)) shall be placed under the discharge valves and the commodity run into bags. After rerailing, the bags shall be emptied into the truck and the reloaded truck shall again be regarded as a truck under fumigation. Workers shall wear gas masks and rubber gloves at all times.

**12.6.3** In the event of a railway accident involving trucks under fumigation, the relevant officers shall be notified. Damaged trucks and spilled commodity shall be guarded, and the relevant officer shall take up his position on the windward side of the truck. If not opened as a result of the accident, the loading hatches of the damaged trucks (or discharge valves if the truck is upside down) shall be opened and the trucks aired for at least 30 min. Thereafter the commodity shall be unloaded and reloaded into empty trucks and new warning notices posted. Commodity spilt on the premises and that cannot be recovered shall be buried under a layer of soil. The emptied damaged trucks shall then be treated as described in 12.6.1.

## **12.7 Unloading and clearance after fumigation**

**12.7.1** At least 5 d shall elapse from the date of fumigation before a fumigated truck is unloaded at the port elevator. Trucks fumigated with methyl bromide on the harbour premises shall remain in the safe siding for the prescribed time before proceeding to the port elevator.

**12.7.2** All fumigated trucks that are to be unloaded shall be shunted onto the same track. If the weather is fine, the loading hatches of at least 10 trucks at a time shall be opened at least 15 min before the trucks are unloaded. In the event of rain, as soon as the first truck is under the shed roof, its loading hatches shall be opened and left open for as long as possible before unloading. Each of the other trucks shall be treated in this way. The loading hatches shall be open while a truck is being unloaded. Workers who open the hatches shall all wear appropriate gas masks.

**12.7.3** During unloading, workers shall stand on the windward side and not too close to the commodity flowing from the truck.

NOTE By using a broom with a long handle, it is possible to sweep out the commodity through the outlet valves without having to enter the truck.

**12.7.4** After the trucks have been cleaned and a test for gas has indicated that there is no more gas left, the warning notices shall be removed from the trucks.

## **13 Fumigation by grain silo operators or fumigators<sup>2)</sup> of grain and other unpackaged edible commodities stored in silo bins**

### **13.1 Initial inspection and notification**

**13.1.1** The GSO or the fumigator shall inspect the silo bin to establish its capacity, its rate of filling and the total time needed to fill the bin or, if a solid fumigant is to be used, the delivery rate of the conveyor belt.

**13.1.2** Notification of the intention to fumigate a silo bin shall be given to workers in rooms adjacent to the bin to be fumigated.

### **13.2 Safety and health precautions**

The GSO or the fumigator shall ensure that all the workers are aware of the relevant provisions of clause 7 and the information given in annex B.

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<sup>2)</sup> Grain silo operators and fumigators employed by the co-operative or the milling plant or the agent of the relevant board.

### **13.3 Fumigation of silo bins with gaseous fumigants**

#### **13.3.1 Preparation of the fumigation area**

**13.3.1.1** The GSO or the fumigator shall check that the appropriate warning notices (all of which shall be kept on permanently) have been posted at the main entrances to the silo bin.

**13.3.1.2** When the fumigant is methyl bromide gas, workers in the silo bin to be fumigated shall not be allowed to remain there during the application of the fumigant.

**13.3.1.3** Unless a permanently installed system is present, a system of pipes shall be so laid as to ensure an even distribution of the fumigant gas and the area around the inlet pipe shall be sealed.

#### **13.3.2 Application of gaseous fumigants**

**13.3.2.1** The GSO or the fumigator shall calculate the required dosage according to the relevant control board's instructions.

**13.3.2.2** The GSO or the fumigator shall then follow the procedures laid down by the national regulations and statutory requirements for the registration of a fumigator (see foreword), and the relevant control board for the application of the gaseous fumigant, and he shall ensure that suitable protective clothing is worn.

**13.3.2.3** The fumigated commodity shall be left undisturbed in the silo bin for the required exposure period recommended by the manufacturer.

### **13.4 Fumigation of silo bins with solid fumigants**

#### **13.4.1 Preparation of the fumigation area**

**13.4.1.1** The GSO or the fumigator shall check that the appropriate warning notices have been posted at the main entrances to the silo bin.

**13.4.1.2** Workers in rooms adjacent to the silo bin to be fumigated should be permitted, if so desired, to remain there on condition that windows are kept open or extra fans are installed so as to ensure good ventilation while the fumigation is in progress. A worker shall not be allowed to sleep in such areas.

#### **13.4.2 Application of the solid fumigant**

**13.4.2.1** The dosage shall be calculated according to the relevant control board's instructions.

**13.4.2.2** The solid fumigant shall be applied either by using a mechanical applicator (see 6.1.1(f)) or by adding the fumigant by hand to the stream of the commodity as it flows into the empty silo bin.

**13.4.2.3** At the point where the fumigant is added to the stream, the area shall be well ventilated, especially when application of the fumigant occurs by hand, and appropriate gas masks shall be worn.

**13.4.2.4** An infested commodity that is already in storage in a silo bin shall be fumigated in the same way by transferring it into an empty bin (or into a partially empty bin that contains the same commodity) following the current procedure laid down by the relevant control board.

**13.4.2.5** The fumigated commodity shall be left undisturbed in the silo bin for the required exposure period recommended by the manufacturer.

### **13.5 Clearance after fumigation**

**13.5.1** At the end of the required exposure time of a gaseous fumigant (see 13.3.1.3), the GSO or the fumigator shall, when relevant, remove all equipment from the silo bin.

**13.5.2** When the grain (or other commodity) has been removed from a fumigated silo bin, fans shall be switched on and no worker shall enter the bin while detectable gas (see 6.1.1(e)) is still present.

## **14 Fumigation by pest control operators of commodities stored in silo bins**

### **14.1 Initial inspection and notification**

**14.1.1** The PCO shall inspect the silo bin to establish its capacity, its rate of filling, and the total time needed to fill the silo bin or, if a solid fumigant is to be used, the delivery rate of the conveyor belt. The PCO shall also carry out a survey on the type and degree of infestation, the humidity of the commodity (for example, grain) to be fumigated, and the temperature inside the silo bin.

**14.1.2** The PCO shall arrange with the manager of the silo bin a suitable time for the fumigation.

**14.1.3** Notification, as described in 8.1, of intention to fumigate a silo bin shall be given to the relevant parties, and also to workers in rooms adjacent to the silo bin to be fumigated.

### **14.2 Safety and health precautions**

The PCO shall ensure that all the workers are aware of the relevant provisions of clause 7 and the information given in annex B.

### **14.3 Preparation of the fumigation area**

**14.3.1** Workers shall observe the conditions given in 13.3.1.2 or 13.4.1.2, as relevant.

**14.3.2** The PCO shall observe the relevant provisions of 8.2.2 and check that the appropriate warning notices have been posted at the entrance to the tunnel beneath the silo bin and at the entrance to the gantry at the top of the bin.

### **14.4 Application of the gaseous fumigant**

The PCO shall proceed as in 13.3.2.

### **14.5 Application of the solid fumigant**

**14.5.1** The dosage shall be calculated according to the manufacturer's instructions.

**14.5.2** The solid fumigant shall be applied, as described in 13.4.2.2, to the stream of the commodity as it flows into the empty silo bin.

**14.5.3** An infested commodity that is already in storage shall be treated as described in 13.4.2.4.

**14.5.4** The fumigated commodity shall be left undisturbed in the silo bin for the required exposure period recommended by the manufacturer.

## **14.6 Clearance after fumigation**

At the end of the required exposure time, the PCO shall remove all warning notices and any remaining equipment from the premises and record all the pertinent data of the fumigation operation (see 8.4).

## **15 Fumigation of stacks of packaged grain, oil seeds and legumes by fumigators<sup>3)</sup>**

### **15.1 Initial inspection and notification**

The fumigator shall inspect the stack to establish its measurements, calculate its volume, and determine the number of gasproof sheets required to cover it and, in the case of fumigation with a gaseous fumigant, the number of channels required in the stack for the promotion of gas distribution.

### **15.2 Safety and health precautions**

The fumigator shall ensure that all the workers are aware of the relevant provisions of clause 7 and the information given in annex B.

### **15.3 Fumigation of stacks with gaseous fumigants**

#### **15.3.1 Preparation of the fumigation area**

**15.3.1.1** The top layers of the stack shall be so rearranged as to provide channels for the promotion of gas distribution and an air space at the gas release nozzles to facilitate evaporation of the gas (thus avoiding wetting and damaging of the gasproof sheets).

**15.3.1.2** Channels shall be approximately 1 m deep and 1 m wide. They shall run parallel to the length of the stack, but shall end approximately 1 m from each end of the stack. The distance between channels shall not exceed 4 m and shall be such that a channel is available for each 8 m of the width of the stack.

**15.3.1.3** Channels shall have closed ends. The top surface of the stack (between channels) shall be flat. Where part of a stack has been removed, channels shall be made on the finished top, and "dams", each of approximate width and length 1,5 m and depth 1 m, shall be scattered on the sloping edge where the units removed in the re-arrangement of the top layer have been packed.

**15.3.1.4** A system of pipes and nozzles shall be so laid that the nozzles protrude over the channels. The distance between nozzles shall preferably be 2 m to 3 m, and shall in no case exceed 4 m. For even distribution of the gas in the system, nozzles shall be spaced symmetrically on either side of the pipeline. Nozzles shall be at least 300 mm away from any package unit (bag or other container) in the stack.

**15.3.1.5** The surface around a stack shall be made sufficiently even to permit gasproof sheets to be effectively sealed to it. Earth surfaces shall be smoothed, and cracks in floor surfaces filled with fine sand. The stacking poles underneath the stack shall be checked to ensure freedom from protruding nails and wires that might tear the gasproof sheets. The ends of poles that protrude excessively shall be sawn off or so covered with sacking as to protect gasproof sheets.

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<sup>3)</sup> Fumigators employed by the co-operative or the milling plant or the agent of the relevant control board.

**15.3.1.6** The gasproof sheets (see 6.1.1(b)) shall be prepared, hoisted over the stack, unfolded and sealed as described in 9.3.13, 9.3.14 and 9.3.15, and care shall be taken not to destroy the layout of the pipes and channels on the stack in the process.

**15.3.1.7** Under windy conditions, rope netting, or ropes that have half a bag of sand tied to each end, shall be so laid across the stack as to keep the sheets from billowing.

At the four corners of the stack, the bunched-up sheets shall be so neatly folded and spread out on the ground as to obtain an effective seal.

**15.3.1.8** The fumigator shall check that the stack has been sealed properly, and that the appropriate warning notices (see 8.2.2) have been posted.

### **15.3.2 Application of gaseous fumigants**

**15.3.2.1** The fumigator shall calculate the required dosage of the gas, according to the manufacturer's instructions.

**15.3.2.2** The fumigator shall then proceed as described in 9.4.3.

**15.3.2.3** The stack shall be left undisturbed for the required exposure period recommended by the manufacturer.

## **15.4 Fumigation of stacks with solid fumigants**

### **15.4.1 Preparation of the fumigation area**

The precautions given in 15.3.1.5 regarding the surface around the stack and the stacking poles underneath it, shall be observed. The gasproof sheets (see 6.1.1(b)) shall be prepared and hoisted over the stack as described in 9.3.13, but shall not be unfolded.

### **15.4.2 Application of solid fumigants**

Before the gasproof sheets are unfolded, the calculated number of solid fumigants shall be distributed over the stack. The stack shall then be covered by the gasproof sheets as described in 9.3.13, 9.3.14 and 9.3.15 and sealed, and warning notices shall be posted (see 8.2.2). The stack shall be left undisturbed for the required exposure period recommended by the manufacturer.

## **15.5 Clearance after fumigation**

**15.5.1** Workers, wearing suitable gas masks, shall loosen and lift the edges of the gasproof sheets around the stack to expedite ventilation.

**15.5.2** After the required ventilation period the fumigator shall check, by means of a suitable gas detector (see 6.1.1(e)), whether the air around the stack is safe.

**15.5.3** When the fumigation area is safe, the gasproof sheets shall be removed from the stack and neatly folded, as in 9.3.13, into thin "snakes" so that they are ready for the next fumigation operation.

**15.5.4** The pipe and nozzle system (where relevant) shall be disconnected and all fumigation equipment and warning notices shall be removed from the site.

## **16 Fumigation of stacks of packaged grain and other commodities by pest control operators**

### **16.1 Initial inspection and notification**

**16.1.1** The PCO shall inspect the stack to establish its measurements, calculate its volume, and determine the number of gasproof sheets required to cover it. In the case of fumigation of stacked bags of grain, oil seeds, legumes or spices with a gaseous fumigant, the number of channels to be packed in the stack for the promotion of gas distribution shall also be calculated. The PCO shall then arrange with the relevant authorities a suitable time for fumigation and provide them with an approximate time of clearance.

**16.1.2** Notification of the intention to fumigate the stack shall be given as described in 8.1.

### **16.2 Safety and health precautions**

The PCO shall ensure that all the workers are aware of the relevant provisions of clause 7 and the information given in annex B.

### **16.3 Fumigation of stacks with gaseous fumigants**

#### **16.3.1 Preparation of the fumigation area**

**16.3.1.1** For stacked bags of grain, oil seeds, legumes and spices, the fumigation area shall be prepared as described in 15.3.1.1 to 15.3.1.5.

**16.3.1.2** For stacks of wood and other commodities, the commodity shall be so stacked as to ensure even distribution of the fumigant gas. All sharp edges shall be so padded as to prevent the gasproof sheets from being torn. A system of pipes and nozzles shall be laid on top of the stack to ensure even distribution of the fumigant gas. The relevant procedures described in 9.3.11, 9.3.13, 9.3.14 and 9.3.15 shall be followed when the stacks are covered with gasproof sheets.

**16.3.1.3** The PCO shall ensure that the areas adjacent to the fumigation areas are vacated and that warning notices have been posted (see 8.2.2).

#### **16.3.2 Application of the gaseous fumigant**

The gaseous fumigant shall be applied to the stacks as described in 9.4.3. The stacks shall then be left undisturbed for the required exposure period recommended by the manufacturer.

### **16.4 Fumigation of stacks with solid fumigant**

The procedures described in 15.4 shall be followed.

### **16.5 Clearance after fumigation**

The procedure described in 15.5 shall be followed, clearance notices shall be issued (see 8.3), and all pertinent data of the fumigation operation shall be recorded (see 8.4).



## **17 Fumigation of commodities in chambers at atmospheric pressure**

### **17.1 General**

Fumigation in chambers at atmospheric pressure is suitable for the control (on a non-emergency basis) of pests in loosely packed commodities such as furniture, books and, in certain cases depending upon the fumigant to be used, plants, seeds, seedlings, flowers and fruit.

### **17.2 Safety and health precautions**

The PCO shall ensure that all the workers are aware of the relevant provisions of clause 7 and the information given in annex B.

### **17.3 Fumigation chambers**

**17.3.1** An atmospheric fumigation chamber shall be of a suitable size and shall be of the stationary or mobile type. Stationary chambers shall be constructed from a suitable gasproof material with carefully sealed joints and seams.

NOTE Mobile chambers are commercially available in different sizes (usually of capacity 2 m<sup>3</sup> or 20 m<sup>3</sup>) and are constructed of metal.

**17.3.2** To be consistently efficient, atmospheric fumigation chambers shall have the following features:

- a) a gastight chamber with a large gastight door to facilitate quick and easy loading;
- b) a circulating system, driven by a petrol or an electric motor, that uses a gastight fan to draw off the fumigating gas to one side of the chamber, lead it around by a pipe or duct to the other side, and blow it into the chamber again. For a liquid formulation, the circulating system incorporates a vaporizer through which the air stream passes and is charged with the fumigant;
- c) a gastight calorifier that increases the efficiency of the fumigant gas by gradually raising the temperature in the chamber; and
- d) in the case of stationary chambers, an exhaust port connected to an industrial exhaust system.

### **17.4 Loading**

When an atmospheric fumigation chamber is being loaded, a space of at least 300 mm shall be allowed between the top of the load and the ceiling. Bagged or packaged goods shall be placed on platforms or pallets, or on a wooden floor rack with ample space between the slats. In order to calculate the fumigant dosage required, the PCO shall determine the lowest temperature in or around the material to be fumigated, and then follow the manufacturer's instructions.

### **17.5 Application of the fumigant**

The door of the chamber and all exhaust ports shall be tightly closed before the fumigant is introduced, except that when a solid fumigant is used, the fumigant shall be introduced immediately before the door is closed. Instructions for the introduction of other types of fumigant (for example, gas or liquid) supplied by the manufacturer of the atmospheric fumigation chamber shall be strictly followed. A warning notice (see 8.2.2) shall be posted on the door of the chamber.

## **17.6 Exposure period**

**17.6.1** The gas circulating system shall be operated for approximately 30 min after the introduction of a gaseous fumigant, and the chamber shall be left undisturbed for the required exposure period recommended by the manufacturer of the fumigant.

**17.6.2** Solid fumigants shall be introduced into the chamber at the recommended dosage, and the chamber shall be left undisturbed for the recommended exposure period.

## **17.7 Clearance after fumigation**

At the end of the exposure period, the exhaust port shall be opened and, in order to expedite ventilation, the fan shall be started. The chamber door shall be opened slightly to allow the entry of fresh air. At least 10 min to 15 min shall elapse before the door is opened completely. Before workers enter the chamber and start unloading, the PCO shall, by means of a suitable gas detector (see 6.1.1(e)), establish that the atmosphere is safe. Warning notices shall then be removed from the door of the chamber.

## **18 Vacuum fumigation of commodities**

### **18.1 General**

A phosphine-releasing fumigant shall not be used in vacuum fumigation as phosphine is unstable at reduced pressures.

NOTE 1 The vacuum fumigation of commodities in an airtight chamber is suitable for the control of pests in tightly packed or baled commodities such as tobacco, jute bags and pressed dates. This method is not suitable for the fumigation of tender plants, fruit and vegetables that are unable to withstand reduced pressures.

NOTE 2 During vacuum fumigation the air in the chamber is removed before the fumigant is introduced. The direct advantages of this procedure are the increased effect of the fumigant in the absence of air and the greater penetration of the gas into the commodity.

### **18.2 Safety and health precautions**

The PCO shall ensure that all the workers are aware of the relevant provisions of clause 7 and the information given in annex B.

### **18.3 Vacuum fumigation chambers**

Vacuum fumigation chambers consist of cylindrical or rectangular steel structures with one or two doors that can be sealed tightly. The chambers are capable of withstanding external pressure of one atmosphere.

Basic additional components of a vacuum fumigation chamber shall include the following:

- a) a pump, capable of evacuating the chamber within a period of 5 min to 15 min;
- b) valves and pipes for the introduction and evacuation of the fumigant; and
- c) a vaporizer for the introduction of a liquid fumigant.

NOTE Vacuum fumigation chambers are commercially available and detailed information on their structure and operation is available from the manufacturers.

## **18.4 Methods of vacuum fumigation**

Vacuum fumigation shall be carried out by one of the following methods, depending on the extent to which the commodity can withstand reduced pressure:

- a) sustained-vacuum fumigation; or
- b) vacuum creation, followed by nearly complete restoration of the pressure, as described in 18.5.2.

## **18.5 Application of the gaseous fumigants**

**18.5.1** During sustained-vacuum fumigation (see 18.4(a)), the pressure in the chamber is reduced to 320 kPa, the fumigant is introduced, and the chamber is kept at the reduced pressure for the entire exposure period (usually 1,5 h to 4 h). The atmospheric pressure is restored in the chamber, after which the fumigant/air mixture is again evacuated. Aeration and evacuation are repeated until the air in the chamber is safe. The chamber is then opened for unloading.

**18.5.2** In the method outlined in 18.4(b), after the initial reduction in pressure, the PCO shall direct the restoration of atmospheric pressure in one of the following ways, in accordance with the instructions of the manufacturer of the chamber:

- a) the fumigant is introduced immediately after evacuation and air is then gradually introduced over a 2 h period in a 3 h exposure period; or
- b) the fumigant is introduced immediately after evacuation, the vacuum sustained for 45 min, and air is then rapidly introduced to restore atmospheric pressure; or
- c) the fumigant is introduced immediately after evacuation and air is then rapidly introduced to restore atmospheric pressure; or
- d) the fumigant and air are introduced simultaneously by means of special metering equipment which maintains a constant proportion of fumigant to air until the entire dosage is produced.

**NOTE** The relative efficacy of the four methods of pressure restoration in terms of pest control is in the sequence (a) to (d), as listed above.

At the end of the exposure period, the fumigant gases are expelled from the chamber by intermittent evacuation and aeration as described in 18.5.1.

## **19 Fumigation of soil**

### **19.1 Inspection**

The PCO shall inspect the soil area to be fumigated and shall (when relevant) estimate the number of gasproof sheets needed. He shall also arrange with the owner a suitable time for the fumigation.

### **19.2 Safety and health precautions**

The PCO shall ensure that all the workers are aware of the provisions of clause 7 and the information given in annex B.

### **19.3 Preparation and application**

**19.3.1** The PCO shall refer to the manufacturer's instructions in order to decide on the mass of the fumigant required by the type of soil to be treated.

**19.3.2** Some fumigants are applied by means of special applicators, for example, mechanical for field application, or hand injectors for use in seedbeds or for spot treatments.

**19.3.3** When sealing is required, transparent gasproof sheets (see 6.1.1(b)) shall be used because opaque or coloured sheets will retain heat, increase in temperature, expand and become more permeable to the gas and more vulnerable to wind damage. The temperature of the soil shall be measured by means of a soil thermometer before the fumigant application.

Methyl bromide shall not be applied when the soil temperature at a depth of 100 mm is below 8 °C.

Gaseous fumigants shall be discharged under the sheets by means of perforated plastics pipes. Liquid fumigants (when used) shall be discharged, by means of suitably perforated plastics pipes, into evaporation jars, one placed on each 10 m<sup>2</sup> area under the gasproof sheets.

**19.3.4** Warning notices (see 8.2.2) shall be posted around the fumigation area.

### **19.4 Ventilation and clearance**

**19.4.1** After the required exposure period, the edges of the gasproof sheets shall be lifted (by workers wearing appropriate protective clothing) to expedite rapid ventilation. The PCO shall check that the area is safe before workers continue with the removal of the sheets and other fumigation equipment.

**19.4.2** All the pertinent data of the fumigation operation shall be recorded as described in 8.4.

**19.4.3** The appropriate interval between fumigation and planting shall be in accordance with the manufacturer's recommendations.

NOTE The length of this period, in the case of methyl bromide, depends on the dosage, the crop and the prevailing soil conditions. When applicable, the soil should be turned over, as recommended by the manufacturer, to aid ventilation before planting.

## **20 Fumigation of containers**

### **20.1 General**

To facilitate the use of a gaseous fumigant, the use of containers with a fumigation nozzle included in their design is recommended.

### **20.2 Initial inspection and notification**

**20.2.1** The PCO or the fumigator shall satisfy himself that the container is in sound condition and gasproof and, if it is not, shall calculate the number of gasproof sheets required to cover it. He shall then arrange a suitable time with the relevant authorities for the fumigation and provide them with an approximate time of clearance.

**20.2.2** Notification of the intention to fumigate the container shall be given as described in 8.1. The PCO or the fumigator shall have readily accessible the address and telephone number of the sponsor.

### **20.3 Safety and health preparations**

The PCO or the fumigator shall ensure that all the workers are aware of the relevant provisions of clause 7 and the information given in annex B.

### **20.4 Fumigation of containers with gaseous fumigants**

#### **20.4.1 Preparation of fumigation area**

**20.4.1.1** Containers to be fumigated indoors shall be in a well-ventilated warehouse. Workers in rooms adjacent to the warehouse shall observe the precautions described in 13.3.1.2.

**20.4.1.2** Containers to be fumigated outdoors and fumigated containers to be stored outdoors shall be moved to areas where workers will not come into contact with the fumigant gas.

**20.4.1.3** The PCO or the fumigator shall observe the relevant provisions of 8.2 and check that warning notices have been posted.

**20.4.1.4** In the case of containers that are not gasproof, all sharp corners and edges shall be so padded as to prevent the gasproof sheets from being torn, and doors and hatches shall be opened. A system of pipes and nozzles shall be so laid that an even distribution of the fumigant gas is obtained during fumigation. The containers shall then be covered with gasproof sheets and the edges sealed as described in 9.3.13, 9.3.14 and 9.3.15.

**20.4.1.5** If gasproof containers have ventilation ports, they shall be sealed with plastics-backed adhesive tape.

**20.4.1.6** If a container does not have a fumigation nozzle, a system of pipes and nozzles shall be laid inside it and the area around the inlet pipe shall be sealed. All doors and hatches shall then be closed.

#### **20.4.2 Application of gaseous fumigants**

The procedure described in 9.4.3 shall be followed.

### **20.5 Fumigation of containers with solid fumigants**

#### **20.5.1 Preparation of the fumigation area**

**20.5.1.1** The precautions outlined in 20.4.1.1 to 20.4.1.3 shall be observed.

**20.5.1.2** In the case of containers that are not gasproof, all sharp corners shall be so padded as to prevent the gasproof sheets from being torn. Doors and hatches shall be opened, and gasproof sheets (see 6.1.1(b)) shall be prepared and hoisted over the container as described in 9.3.13, but shall not be unfolded.

**20.5.1.3** If gasproof containers have ventilation ports, they shall be sealed with plastics-backed adhesive tape (see 6.1.1(c)) and all hatches and doors closed except those through which the solid fumigants will be introduced.

## **20.5.2 Application of the solid fumigants**

**20.5.2.1** When grain and other edible commodities are to be fumigated during transit, phosphine-releasing solid fumigants in the form of plates or sachets should be used to facilitate easy removal of residues.

**20.5.2.2** The calculated number of solid fumigants shall be distributed on the floor of the empty container, and evenly spaced on the upper surface of the stacked or bulk loose commodity.

**20.5.2.3** In the case of containers that are not gasproof, the gasproof sheets shall then be unfolded and sealed as described in 9.3.13, 9.3.14 and 9.3.15.

**20.5.2.4** All doors and hatches of gasproof containers shall be closed.

**20.5.2.5** A suitable pictogram of size at least 250 mm × 250 mm and bearing the warning **"WARNING: CONTAINER UNDER FUMIGATION: DO NOT OPEN"** and details of the type and amount of fumigant used and the date and time of fumigation, shall be affixed to the side of each container.

**20.5.2.6** The consignor shall notify the transport contractor that the containers to be transported are under fumigation. The date and time of fumigation and the type and amount of fumigant used shall be indicated on all transport documents.

NOTE Containers under fumigation should be hauled under unit control.

## **20.6 Clearance after fumigation**

**20.6.1** Workers wearing suitable protective clothing shall loosen and lift the edges of the gasproof sheets around the container or shall open the doors, hatches and ventilation ports of the gasproof containers (as relevant) to expedite ventilation.

**20.6.2** After the required ventilation period, the PCO or the fumigator shall check, by means of an appropriate gas detector (see 6.1.1(e)), whether the air in and around the container is safe, and continue ventilation until it is safe.

**20.6.3** The gasproof sheets shall be removed and neatly folded as in 9.3.13, and the pipe and nozzle system shall be disconnected. All doors and hatches shall then be closed.

**20.6.4** Fumigation equipment and warning notices shall be removed from the site, clearance notices shall be issued (see 8.3) and all pertinent data of the fumigation operation shall be recorded (see 8.4).

**20.6.5** Containers under fumigation with methyl bromide shall not be accepted for transportation until clearance notices have been issued.

## **Annex A**

(normative)

### **First-aid kit**

**A.1** A first-aid kit for use in cases of pesticide poisoning shall contain at least the following:

- a) wound cleaner;
- b) swabs for cleaning wound;
- c) cotton wool for padding;
- d) sterile gauze swabs;
- e) one pair of forceps;
- f) one pair of scissors (100 mm);
- g) one card of safety pins;
- h) bandages:
  - 1) 12 triangular bandages;
  - 2) six roller bandages (80 mm × 50 m);
  - 3) six roller bandages (100 mm × 5 m); and
  - 4) one roll of elastic adhesive bandage (25 mm × 3 m);
- i) one roll of non-allergenic adhesive strip (25 mm);
- j) one packet of adhesive dressing strips;
- k) dressings:
  - 1) one large dressing (75 mm × 100 mm); and
  - 2) six shell dressings (150 mm × 200 mm);
- l) two straight splints;
- m) eye-wash bottle containing distilled water or rinse solution;
- n) drinking glass or feeding cup;
- o) flask of fresh water (at least 5 L);
- p) blankets;
- q) washing basins/pails;
- r) towels;

- s) soap;
- t) sponges;
- u) two pairs large and two pairs medium disposable latex gloves;
- v) spoons;
- w) spare clothing;
- x) a disposable protective mouthpiece;
- y) a manual respiratory resuscitating device; and
- z) an oxygen manual kit.

**A.2** The following items shall be available at the medical station for use by nursing staff and by medical practitioners:

- a) Ipecacuanha Tincture (BP);
- b) about 200 g activated charcoal in powder form or tablet form; and
- c) any special equipment, antidotes, etc., that may be required, in view of the specific chemicals to be applied.

NOTE Antidotes should be kept separate from items.

## **Annex B**

(normative)

### **The toxicity of fumigants, the symptoms of poisoning, and first-aid treatment in cases of suspected poisoning**

#### **B.1 Toxicity of fumigants**

##### **B.1.1 Degree of toxicity**

###### **B.1.1.1 General**

It should be noted that the labels on fumigant containers indicate the degree of toxicity of the active ingredient in accordance with the regulations of the Fertilizers, Farm Feeds, Agricultural Remedies and Stock Remedies Act, 1947 (Act No. 36 of 1947).

###### **B.1.1.2 Group 1**

Group 1 includes pesticides containing (an) active ingredient(s) with an oral LD50 of less than a mass fraction of 0,005 % and a dermal LD50 of less than a mass fraction of 0,02 %, or pesticides that are extremely hazardous for some other reason. Containers are marked **"POISON: EXTREMELY TOXIC"** and show the skull-and-crossbones sign.



### **B.1.1.3 Group 2**

Group 2 includes pesticides containing (an) active ingredient(s) with an oral LD50 of 0,0051 % to 0,05 % mass fraction and a dermal LD50 of 0,0201 % to 0,2 %. Containers are marked **"POISONOUS"**.

### **B.1.1.4 Group 3**

Group 3 includes pesticides containing (an) active ingredient(s) with an oral LD50 of 0,0501 % to 95 % mass fraction and a dermal LD50 of more than 0,2 % mass fraction. Containers are marked **"CAUTION"**.

### **B.1.1.5 Group 4**

Group 4 includes pesticides containing (an) active ingredient(s) with an oral LD50 of more than 0,5 % mass fraction and a dermal LD50 of more than 0,2 % mass fraction. Containers bear no special markings.

## **B.1.2 Nature and routes of poisoning**

The poisonous action of pesticides is based on the intake of these substances by the body via three routes, i.e. through

- a) the skin and the mucous membranes,
- b) the mouth, and
- c) the respiratory organs.

The poisoning can be either acute (i.e. caused by a single intake of a sufficiently large quantity of a chemical) or chronic (i.e. poisoning caused by repeated intakes of small quantities of a chemical over an extended period of time). In addition, skin or eye irritation can occur in individuals who are susceptible to these chemicals.

## **B.2 Symptoms of poisoning**

### **B.2.1 Hydrogen cyanide**

Symptoms of chronic poisoning are fatigue, weakness, vertigo, nausea, vomiting, increasing irritation of the mucous membranes of the eyes, throat or upper respiratory tract, and a sensation of pressure in the forehead. Symptoms of acute poisoning include those of chronic poisoning and a burning sensation on the tongue, a metallic and irritating taste in the mouth, constriction of the throat, and with the exhaled breath sometimes smelling of bitter almonds. There is general oppression, confusion, disturbed equilibrium, stabbing pain in the head, foaming at the mouth, dilated pupils, hypo-tension, violent tenesmus (voiding of bowels) and convulsions, rapid heart beats (more than 100/min), rapid deep breathing changing to shallow breathing accompanied by a rush of blood to the head, and paralysis, respiratory arrest and coma. Death can occur within 15 min to 1 h.

**B.2.2 Methyl bromide**

Symptoms of chronic poisoning are central nervous system depression and renal failure. Acute poisoning shows the following symptoms: drunkenness followed by double or blurred vision, impaired or slurred speech, mental confusion, hyperactivity, numbness of the extremities, dizziness, nausea and vomiting, skin rashes of various types, unusual fatigue, headache, loss of appetite, abdominal pain, ataxia (lack of co-ordination), mania, convulsions, stupor, central nervous system depression, renal failure, coma, and circulatory and respiratory failure. Exposure to high concentrations could also cause pulmonary oedema and narcosis. Symptoms might be delayed from 8 h to 48 h.

**B.2.3 Phosphine**

Depending upon the quantity of gas inhaled, symptoms of poisoning might appear immediately or only after a few hours. The symptoms are general fatigue, a feeling of coldness, nausea, abdominal pain, vomiting, diarrhoea, dizziness and staggering gait, pains in the chest, dyspnoea (rapid shallow breathing) and oliguria (scanty urination). Very serious poisoning rapidly results in strong dyspnoea, bronchitis, cyanosis, agitation, tetany (intermittent muscular contractions), ataxia (lack of co-ordination), anoxemia (low tension of oxygen in arterial blood) and unconsciousness. Death can occur immediately or days later, caused by pulmonary oedema and collapse or paralysis of the central nervous system, or by oedema of the brain (or both).

**B.2.4 Ethylene dibromide**

Inhalation of ethylene dibromide causes pulmonary lesions and liver damage. It is a recognized potential carcinogenic. Symptoms of poisoning are nausea and vomiting, headache, irritation of mucous membranes, abdominal pain, excitability, drowsiness, dizziness, delirium, respiratory slowing, drop in blood pressure, twitching of muscles, central nervous system depression, pulmonary oedema, cyanosis and coma.

**B.2.5 Ethylene oxide**

Ethylene oxide causes intense irritation of the skin (blisters), mucous membranes and lungs, with the production of pulmonary oedema. Further symptoms of severe poisoning are nausea, vomiting, diarrhoea, headache, vertigo, central nervous system depression with dyspnoea and respiratory arrest, and liver and kidney damage, all resulting in death.

**B.2.6 Ethylene dichloride**

Symptoms of poisoning are drowsiness, giddiness, headache, irritation of mucous membranes, corneal clouding and lacrymation, mental confusion, insomnia, vertigo, abdominal cramps, nausea and vomiting. More severe symptoms may follow one or two weeks later, especially cellular necrosis of the kidneys and liver with uremia (excess urea in blood), oliguria, dyspnoea and convulsions. Central nervous system depression and respiratory failure might precede death.

**B.2.7 Carbon disulfide**

Carbon disulfide is a cumulative poison and chronic exposure to it leads to disturbance of peripheral nerve functions and of vision (absence of corneal reflex). These symptoms are followed by weight loss, neuropsychiatric effects (such as emotional disorders, depression, psychoses, mania, hallucinations and parkinsonism), multiple peripheral neuritis, weakness and paralysis. Acute poisoning is characterized by irritation of the skin, eyes and mucous membranes, headache, garlicky breath, nausea, vomiting, diarrhoea, abdominal pain, weak pulse, palpitations, fatigue, unsteady gait, neuropsychiatric effects (as with chronic poisoning), central nervous system depression with respiratory paralysis, and coma or convulsions resulting in death.

### B.3 First-aid treatment in cases of suspected poisoning

**B.3.1** In the case of a suspected poisoning, a medical practitioner shall be summoned immediately and first-aid measures taken until he arrives. Alternatively, first-aid shall be initiated and the poisoned person taken to the medical practitioner as a matter of urgency.

The medical practitioner shall be informed of the common name (as given directly under the trade mark on the label) or the chemical name of the active ingredient of the fumigant.

The label of the fumigant and the works-exposure record card of the poisoned worker shall be shown to the medical practitioner upon arrival.

**B.3.2** The following preliminary first-aid measures shall be taken immediately by one of the trained members of the team:

a) If the poisoning was caused by inhalation of a chemical, remove the patient from exposure to the contaminated atmosphere.

b) If breathing has stopped, apply artificial respiration.

NOTE Where poisoning was caused by phosphine, methyl bromide or cyanide, mouth-to-mouth resuscitation could be fatal to the first-aider.

If breathing is difficult, administer oxygen, but not for more than 1 h.

c) If the heart has stopped beating, apply external cardiac massage.

d) Remove clothing soiled with chemicals, rinse the skin with clean cool water (to avoid heating of the skin which could promote absorption), then sponge gently with cool water and soap, and finally rinse with clean cool water. For his own protection, the person washing the patient shall wear clean impermeable gloves.

e) If the eyes are contaminated, flush them with clean cool water for at least 15 min and consult a medical practitioner.

f) A patient shall never be given anything to drink if he is unable, for reasons other than incapacitating hand injuries, to hold the drinking glass himself.

If a fumigant emulsifiable concentrate, or a solution that contains volatile liquids or solvents has been swallowed and the patient is fully conscious, DO NOT INDUCE VOMITING. Administer instead copious quantities of a demulcent (such as beaten egg whites, a solution of starch, or milk of magnesia). If material THAT DOES NOT CONTAIN VOLATILE SUBSTANCES has been swallowed, induce vomiting by getting the patient to drink 50 mL of emetic Ipecacuanha syrup, followed by a glass of cold water to facilitate emesis. Administer four or five tablets or one tablespoonful of activated charcoal in a glass of water after emesis.

g) If the patient is unconscious, preferably lie him on his right side with the right leg straight, the left knee drawn up and the head so bent backwards that the respiratory tract is kept clear. Remove artificial teeth, loosen clothing round the neck, chest and abdomen, and keep the patient quiet and lightly covered. If he vomits, clean out his mouth and throat.

h) If there is any possibility that the fumigant has been swallowed, retain all vomitus for analysis and, when relevant, advise the medical practitioner of the presence of petroleum distillates or other hydrocarbon solvents.